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(72) Inventor: HONDO, Fusahide  
Ota-ku, Tokyo 143-0023 (JP)

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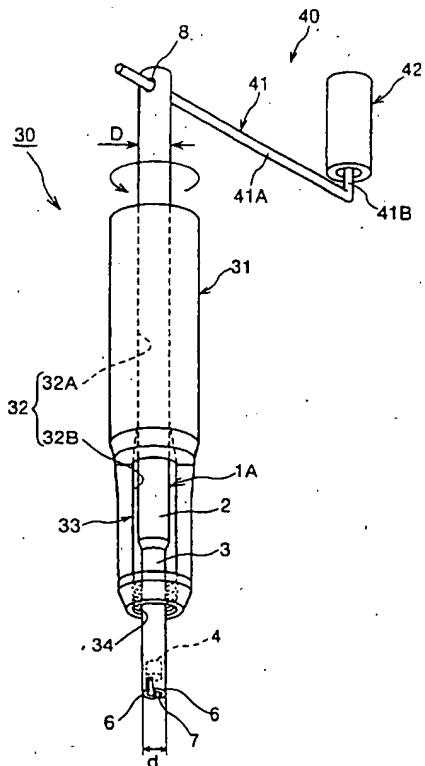
(74) Representative: Greenwood, John David et al  
Graham Watt & Co.  
Riverhead  
Sevenoaks Kent TN13 2BN (GB)

(71) Applicant: Nippon Sprew Co. Ltd.  
Tokyo 105-0004 (JP)

**(54) TONGUE BEND-BREAKING AND REMOVING TOOL, AND TONGUE BEND-BREAKING AND REMOVING TOOL USED ALSO AS TONGUED SPIRAL COIL INSERT INSERTING TOOL**

(57) The present invention provides a tang break-off tool which makes it possible to break off the tang after inserting the spiral coil insert with the tang into the tap-hole of the work, and further, to easily and with certainty remove the broken tang. The tool has a holding section 2 and an operating section 3, and has a permanent magnet 4 provided at the leading end of the operating section 3.

**FIG. 7**



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**Description****Technical Field**

[0001] The present invention relates to a tang break-off tool which permits breaking off a tang after inserting a spiral coil insert with a tang into a taphole of a work, and the further removal of the tang as broken off, and a tang break-off tool which also serves as an insertion tool for the tanged spiral coil insert.

**Background Art**

[0002] When a weak female screw makes it impossible to obtain a high tightening force while directly tapping into a work comprising a light metal such as aluminum, plastics, wood or cast iron, it is the conventional practice to use a tanged spiral coil insert for the purpose of ensuring a high reliable screw tightening. Fig. 5 illustrates an example of the tanged spiral coil insert.

[0003] As shown in Fig. 5, a spiral coil insert with a tang 10 is usually manufactured by winding a high strength special steel wire having a rhombic cross-section into a spring-shaped cylinder. It is screwed into a taphole 101 formed in a work 100 by means of an insertion tool, as shown in fig. 6, and fixed therein. Thereafter, a bolt 20 or the like is screw-engaged with this spiral coil insert 10 as a female screw. By using the spiral coil insert 10 as described above, it is possible to obtain a high screw tightening force, to repeatedly insert the bolt 20, and to remove the same.

[0004] Because the tanged spiral coil insert 10 is screwed into the taphole 101 by the use of the insertion tool as described above, a stopper piece 11, folded in the radial direction of the coil, known as a tang engaged to the insertion tool is provided at the coil free end as shown in fig. 5. After the coil insert 10 is secured in the taphole 101 of the work 100, this tang must be removed. For this purpose, a notch 12 is formed on the outer side surface of the coil at a first coil portion to be connected to the coil free end on which the tang 11 is formed.

[0005] From the tanged spiral coil insert 10 as described above, the tang 11 is broken off after attachment to the work 100, and the broken tang 11 must be collected. Particularly when the taphole 101 of the work 100 takes the form of a blind hole, this operation is very difficult. If collection of the separated tang 11 fails, the tang 11 may cause electrical or mechanical failure. It is therefore necessary to remove the separated tang without fail.

[0006] When the taphole 101 of the work 100 is formed into a blind hole, it is the present practice to remove the separated tang 11 by, for example, tilting the work 100. This practice is not effective however when the work is large in size. When the tanged spiral coil insert 10 is large in size, the separated tang can be removed by the use of a pincer or the like. However, in the case of a small-diameter tanged spiral coil insert 10,

this practice is sometimes not applicable. There is therefore a demand for a method of certain and easy removal of the separated tang.

[0007] As a result of extensive studies and experiments carried out to solve the above-mentioned problems, the present inventor obtained the following findings. Even when a tanged spiral coil insert 10 is prepared through many cold working steps by the use of 18-8 stainless steel (SUS304) wire usually considered to be a non-magnetic material, the prepared tanged spiral coil insert 10 exhibits properties of magnetic material. The inventor found, in view of this fact, the possibility of being able to remove a snapped tang by attracting it with a magnet.

[0008] The present invention is based on such novel findings obtained by the inventor.

[0009] Accordingly, it is an object of the present invention to provide a tang break-off tool which, after attaching a spiral coil insert with a tang to a taphole of a work, makes it possible to break off the tang, and further, to facilitate the easy and certain removal of the broken tang.

[0010] It is another object of the present invention to provide a tang break-off tool serving also as an insertion tool for a tanged spiral coil insert, which makes it possible to attach a spiral coil insert with a tang to a taphole of a work, and which, after attaching the tanged spiral coil insert to the taphole of the work, makes it possible to break off the tang, and further, to facilitate the easy and certain removal of the broken tang.

**Disclosure of the Invention**

[0011] The aforementioned objects are achieved by the use of the tang break-off tool and the tang break-off tool serving also as an insertion tool for the tanged spiral coil insert of the invention. In summary, according to the first present invention there is provided a tang break-off tool having a holding section, an operating section and a permanent magnet provided on the leading end of the operating section.

[0012] According to an embodiment of the first present invention, the above-mentioned permanent magnet is secured in a recess formed on the leading end of the operating section. The permanent magnet should preferably not project from the leading end of the operating section.

[0013] According to the second invention, there is provided a tang break-off tool serving also as an insertion tool for a tanged spiral coil insert, comprising a sleeve holder having a throughhole in the axial direction thereof, and a mandrel held slidably by said sleeve holder, wherein:

the mandrel has a holding section and an operating section;  
a permanent magnet is provided and a tang engaging section is formed at a leading end of the oper-

ating section; and the tang engaging section projects outside in the axial direction of the mandrel and may engage with the tang of the tanged spiral coil insert.

[0014] According to an embodiment of the second present invention, the permanent magnet is secured in a recess formed at the leading end of the operating section.

[0015] According to another embodiment of the second present invention, preferably, the tang engaging section has a slit for engaging with the tang of the tanged spiral coil insert, and the depth of the slit does not reach the magnet provided in the recess.

#### Brief Description of Drawings

##### [0016]

Fig. 1 is a perspective view illustrating an embodiment of the tang break-off tool of the present invention;

Fig. 2 is an enlarged sectional view illustrating the configuration of the leading end of the tang break-off tool of the invention;

Fig. 3 illustrates the manner of use of the tang break-off tool of the invention;

Fig. 4 illustrates the manner of use of the tang break-off tool of the invention;

Fig. 5 is a perspective view of a tang spiral coil insert;

Fig. 6 illustrates the tanged spiral coil insert being attached to a work;

Fig. 7 is a perspective view illustrating an embodiment of the tang break-off tool serving also as an insertion tool for a tanged spiral coil insert of the present invention;

Fig. 8 is an enlarged sectional view illustrating the configuration of the leading end of the tang break-off tool serving also as an insertion tool for a tanged spiral coil insert of the invention;

Fig. 9 is a front view illustrating the configuration of the leading end of the tool as viewed from line A-A in Fig. 8;

Fig. 10 illustrates the manner of attachment of the tanged spiral coil insert to the tang break-off tool serving also as an insertion tool for a tanged spiral coil insert of the present invention; and

Fig. 11 illustrates the manner of use of the tang break-off tool serving also as an insertion tool for a tanged spiral coil insert of the invention;

#### Best Mode for Carrying Out the Invention

[0017] The tang break-off tool and the tang break-off tool serving also as an insertion tool for the tanged spiral coil insert of the present invention will now be described in further detail with reference to the drawings.

#### Embodiment 1

[0018] Fig. 1 illustrates an embodiment of the tang break-off tool of the invention. According to this embodiment, the tang break-off tool 1 has a holding section 2 and an operating section 3. The holding section 2 has a size which permits easy grip by an operator: in this embodiment, the holding section 2 has a diameter (D) of 10 mm and a length of 8 cm, but is not limited. The geometry of the operating section 3, varying with the size of the tanged spiral coil insert 10 used, comprises a diameter of 4 mm and a length of 3.5 cm in this embodiment, so that it serves as a tool for a tanged spiral coil insert 10 having an inside diameter of 5 mm and a length of about 1 cm. In this embodiment, the holding section 2 and the operating section 3 are prepared as one body from a steel material such as S45C, but it may be made of any arbitrary material.

[0019] According to the invention, as shown in Fig. 2, a permanent magnet 4 is arranged on the leading end of the operating section 3. In this embodiment, a recess 5 is formed at the leading end of the operating section 3, and the permanent magnet 4 is secured in the recess 5 with an adhesive or the like. It is preferable that the permanent magnet 4 does not project from the leading end of the operating section 3: in the present embodiment, it is located at a position about 0.5 mm in depth (h2). In this configuration, upon breaking off a tang 11 with the tool, it is possible to prevent the permanent magnet 4 from coming into contact with the tang 11 and causing a damage thereto.

[0020] The strength of the magnet 4 is such that the tang snapped off from the tanged spiral coil insert 10 can be attracted. In this embodiment, a magnet having a diameter (d1) of 3 mm and a height (h1) of 4 mm and having different magnet poles on both surfaces as shown in Fig. 2 is used, but the geometry of the magnet 4 is not limited to this.

[0021] A manner of use of the tool 1 having the above-mentioned configuration of the invention will now be described with reference to Fig. 3.

[0022] As shown in Fig. 3(A), when the tanged spiral coil insert 10 is attached to the work 100, the tool 1 of the invention is inserted into the tanged spiral coil insert 10, and brings the leading end of the operating section 3 into contact with the tang 11 of the tanged spiral coil insert 10. Then, the tang 11 is broken off at a notch 12 (Fig. 5) by hitting the top end of the holding section 2 with a tool such as a hammer. The tang 11 broken off as described above is illustrated in Fig. 3(B). It is needless to mention that the tanged spiral coil insert 10 is prepared from a material having properties of a magnetic material as a result of cold working, such as a 18-8 stainless steel wire, or an arbitrary material believed to be magnetic material.

[0023] After breaking off the tang 11, the snapped tang 11 is attracted by the magnet 4 of the operating section 3 at the leading end of the tool, as shown in Fig.

3(C), by causing the tool 1 to descend. In this state, the tang 11 can be taken out as shown in Fig. 4 by pulling up the tool 1.

### Embodiment 2

[0024] Fig. 7 illustrates an embodiment of the tang break-off tool serving also as an insertion tool for a tanged spiral coil insert of the present invention.

[0025] According to this embodiment, the tang break-off tool serving also as an insertion tool for a tanged spiral coil insert 30 of the invention has a sleeve holder 31 having a throughhole 32 in the axial direction thereof, and a mandrel 1A held slidably by the sleeve holder 31. The sleeve holder 31 is not limited to that shown, but should have a size suitable for an operator to grip it by hand for operation, for example, a diameter of 2.5 cm and a length of about 13.5 cm. The throughhole 32 of the sleeve holder 31 is a stepped hole having a small-diameter hole 32A forming an upper portion and a large-diameter hole 32B forming a lower portion.

[0026] An opening 33 is formed at the position of the large-diameter hole 32B below the sleeve holder 31. As described later in detail, when screw-attaching the tanged spiral coil insert 10 into a tap hole 101 of a work 100, the tanged spiral coil insert 10 to be inserted into the tap hole 101 is inserted into the large-diameter hole 32B, as shown in Fig. 10, via the opening 33.

[0027] The mandrel 1A has the same configuration as that of the tang break-off tool 1 described in Embodiment 1, and has a holding section 2 and an operating section 3. In this embodiment, the holding section 2 has a larger diameter than the operating section 3. The holding section 2 of the mandrel 1A slidably engages with the small-diameter hole 32A of the sleeve holder 31.

[0028] The mandrel 1A can be designed into any arbitrary size and shape. In this embodiment, the holding section 2 has a diameter (D) of 10 mm, and a length of 13 cm. The size of the operating section 3, variable with the side of the tanged spiral coil insert 10 used, being a tool for a tanged spiral coil insert 10 having an inside diameter of 10 mm and a length of about 2 cm in this embodiment, comprises a diameter (D) of 8 mm and a length of 4 cm. In this embodiment, the mandrel 1A is prepared integrally from a steel such as, for example, S45C, but may be made of any other material.

[0029] According to this embodiment, as is well understood with reference to Figs. 8 and 9, a permanent magnet 4 is provided at the leading end of the operating section 3 as described above as to Embodiment 1, and furthermore, a tang engaging section 6 is formed at the leading end of the section 3, which projects from the permanent magnet 4 outside in the axial direction of the mandrel 1A and may engage with the tang 11 of the tanged spiral coil insert 10.

[0030] In this embodiment, as shown in Fig. 8, a recess 5 having a circular cross-section is formed with a diameter d1 and a depth h (= h1 + h2 + h3) at the leading

end of the mandrel 1A, and the permanent magnet 4 is secured to the leading end of the operating section 3, i.e., at the portion having a depth h1, for example, with an adhesive.

[0031] The tang engaging section 6 is formed by projecting outside further in the axial direction of the mandrel 1A from the recess position of the operating section to which the permanent magnet is secured. In this embodiment, the tang engaging section 6 is provided by forming a slit 7 having a depth h3 and a width w from the leading end of the recess 5. The tang engaging section 6 in this embodiment is integrally formed at the leading end of the operating section 3. It is also possible to prepare a tang engaging section 6 as a separate member as required, and attach it to the leading end of the operating section.

[0032] As described above, the slit 7 should preferably have a depth h3 which does not reach the magnet 4 arranged in the recess 5. In this embodiment, the slit 7 has a depth h3 of 3.5 mm and a width w of 3 mm, and the permanent magnet 4 is arranged further inside the slit 7 by a depth h2 of 0.5 mm. By using this configuration, as described later in detail, when inserting the tanged spiral coil insert 10 by means of the tool, or further, when breaking off the tang 11 thereafter, the permanent magnet can be prevented from being damaged in contact with the tang 11.

[0033] The strength of the magnet suffices to be to an extent permitting attraction of the broken-off tang of the tanged spiral coil insert 10. In this embodiment, as in Embodiment 1, the magnet has a diameter (d1) of 3 mm and a height (h1) of 4 mm, and different magnetic poles are formed on the different sides, but the magnet is not limited to this.

[0034] According to this embodiment, a handle 40 for rotating the mandrel 1A is provided at the top of the holding section 2 of the mandrel 1A. The handle 40 has a handle shaft 41 having a straight portion 41A freely insertable into a hole 8 pierced through the upper end of the holding section 2 of the mandrel 1A in the radial direction, and a perpendicular portion 41B bent by 90° relative to the straight portion 41A. A knob 42 is rotatably attached to the perpendicular portion 41B of the handle shaft 41.

[0035] An embodiment of application of the tool 30 having the configuration described above of the invention will now be described with reference to Figs. 10 and 11.

[0036] As shown in Fig. 10, the mandrel 1A is lifted up, and the tanged spiral coil insert 10 is inserted into a space formed by the large-diameter hole 32B at the position of the opening 33 of the sleeve holder 31. In this embodiment, a spiral groove 34 is formed in the lower leading end of the sleeve holder 31. By adopting this configuration, it is suitably possible to prevent the tanged spiral coil insert 10 inserted into the large-diameter hole 32B via the opening 33 from dropping from the leading end of the sleeve holder 31.

[0037] Then, the mandrel 1A is moved down, and the slit 7 of the stopper section 6 at the leading end thereof is engaged with the tang of the tanged spiral coil insert 10. In this state, by causing the mandrel 1A to rotate in a prescribed direction by operating the handle 40, the tanged spiral coil insert 10 is screwed into the spiral groove 34 at the lower leading end of the sleeve holder 31. Furthermore, by further rotating the mandrel 1A, the tanged spiral coil insert 10 is screwed into the tap hole 101 of the work 100, as shown in Fig. 11(A).

[0038] When the tanged spiral coil insert 10 is screwed into the tap hole 101 of the work 100, as shown in Fig. 11(B), and fixed at a prescribed position, the tang 11 is broken off at a notched portion 12 (Fig. 5) by tapping the upper end of the holding section 2 of the mandrel 1A with a tool such as a hammer. The state of the tang broken off as described above is shown in Fig. 11(C). It is needless to mention that the tanged spiral coil insert 10 is made of a material having properties as a magnetic material through a cold working, such as 18-8 stainless steel wire, or of any material believed to be a magnetic material.

[0039] By bringing down the mandrel 1A after breaking off the tang 11, the tang 11 broken off is attracted by the magnet 4 of the operating section 3 at the leading end of the tool, as shown in Fig. 11(D). By lifting up the mandrel in this state, the tang 11 can be taken out to the outside.

#### Industrial Applicability

[0040] As described above, the tang break-off tool of the present invention has a holding section and an operating section, and a permanent magnet is provided at the leading end of the operating section. The tang break-off tool serving also as an insertion tool for a tanged spiral coil insert has a sleeve holder having a throughhole in the axial direction thereof, and a mandrel held slidably by the sleeve holder. The mandrel has a holding section and an operating section, and a permanent magnet is provided at the leading end of the operating section. There is formed a tang engaging section which projects outside in the axial direction of the mandrel and may engage with the tang of the tanged spiral coil insert. It is therefore possible to break off the tang after attaching the tanged spiral coil insert into a tap hole of a work, and to remove the tang thus broken off very easily without fail.

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#### Claims

1. A tang break-off tool having a holding section and an operating section, wherein a permanent magnet is provided at a leading end of said operating section.
2. A tang break-off tool according to claim 1, wherein

said permanent magnet is secured in a recess formed at the leading end of said operating section.

3. A tang break-off tool according to claim 1 or 2, wherein said permanent magnet does not project from the leading end of said operating section.
4. A tang break-off tool serving also as an insertion tool for a tanged spiral coil insert, comprising a sleeve holder having a throughhole in the axial direction thereof, and a mandrel held slidably by said sleeve holder, wherein:
 

said mandrel has a holding section and an operating section;  
a permanent magnet is provided and a tang engaging section is formed at a leading end of said operating section; and  
said tang engaging section projects outside in the axial direction of the mandrel and may engage with the tang of the tanged spiral coil insert.
5. A tang break-off tool serving also as an insertion tool for a tanged spiral coil insert, according to claim 4, wherein said permanent magnet is secured in a recess formed at the leading end of said operating section.
6. A tang break-off tool serving also as an insertion tool for a tanged spiral coil insert, according to claim 5, wherein said tang engaging section has a slit for engaging with the tang of the tanged spiral coil insert, and the depth of the slit does not reach the magnet provided in said recess.

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FIG.1

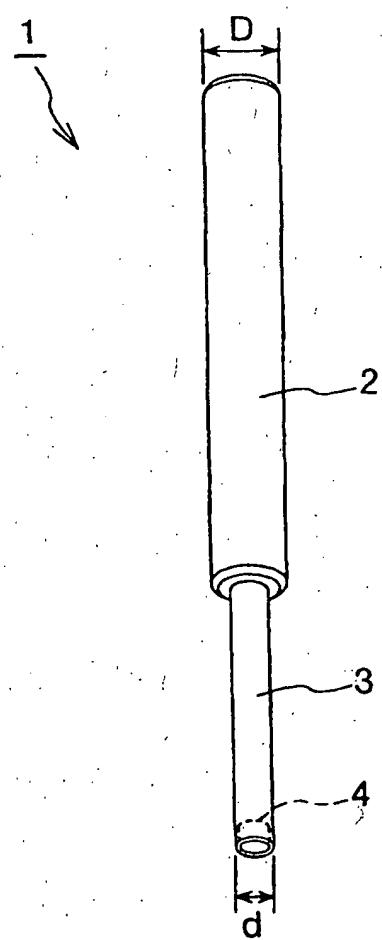


FIG.2

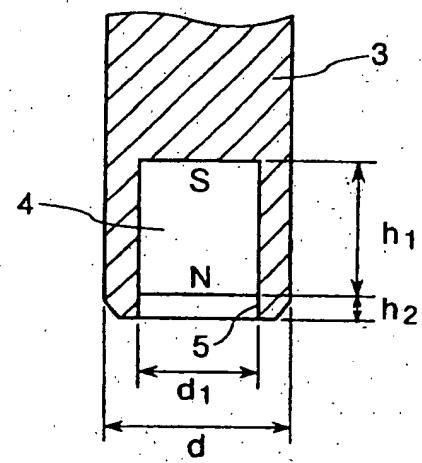
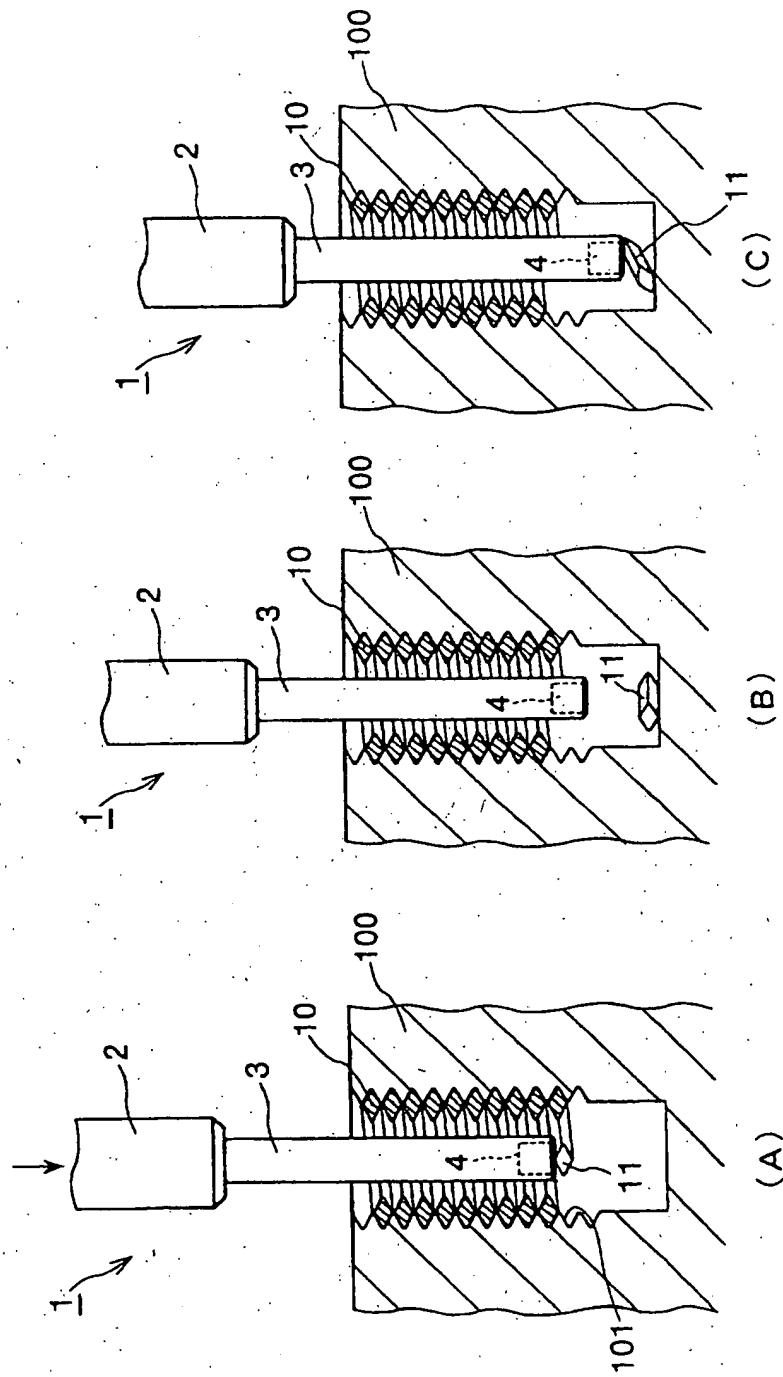
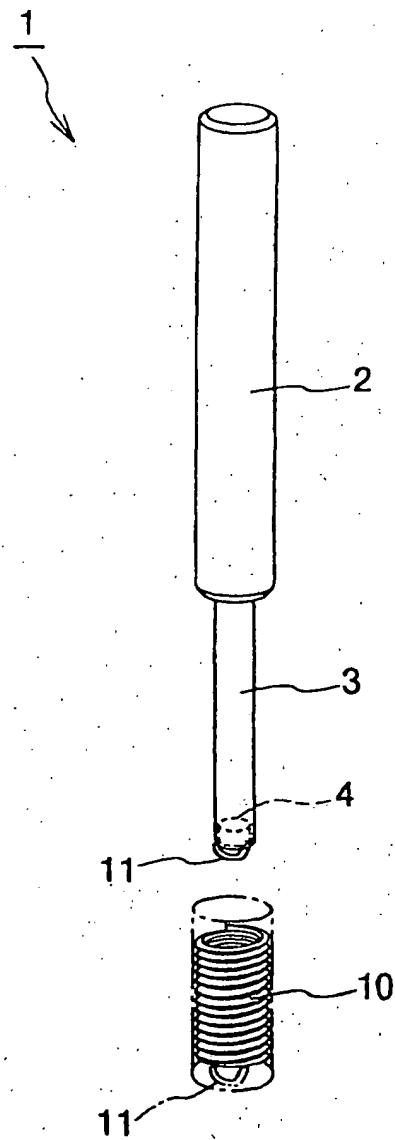


FIG.3



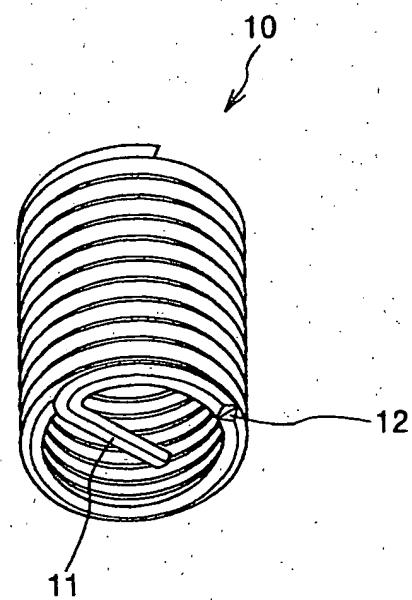
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FIG.4



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FIG.5



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FIG.6

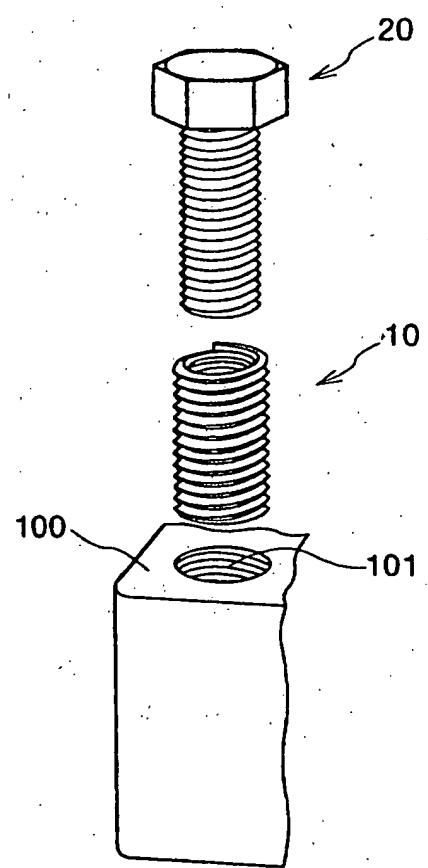


FIG. 7

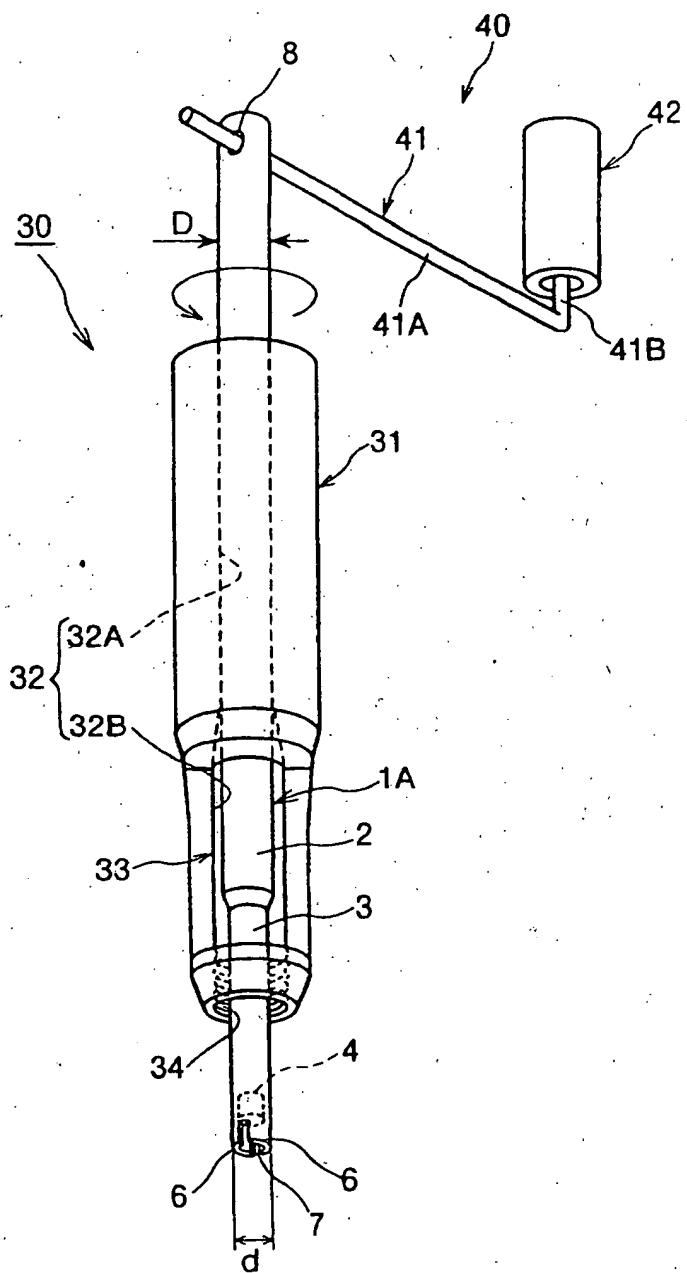
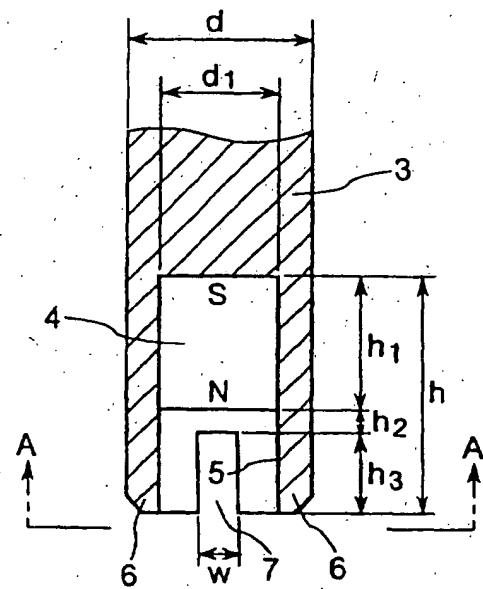


FIG. 8



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FIG.9

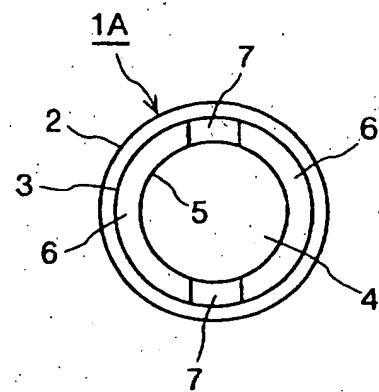


FIG.10

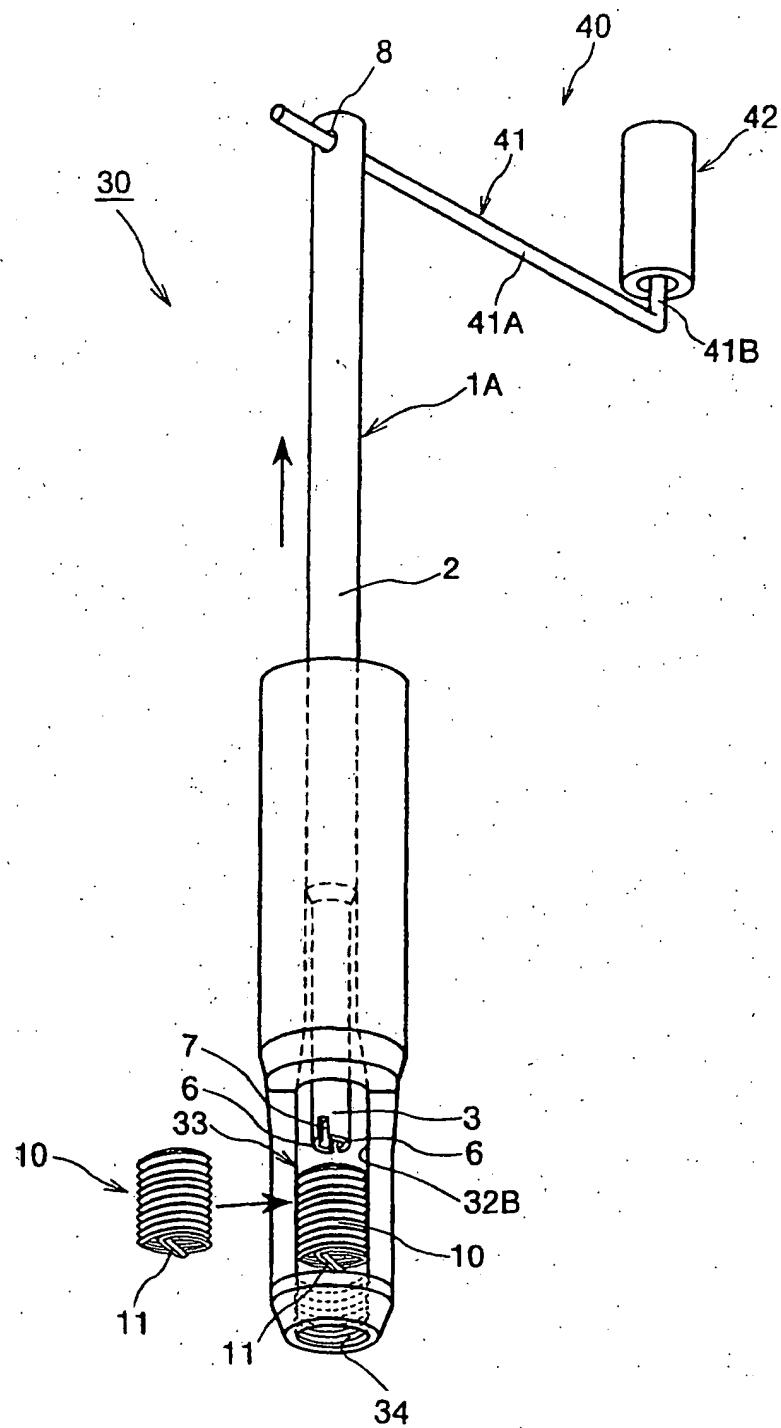
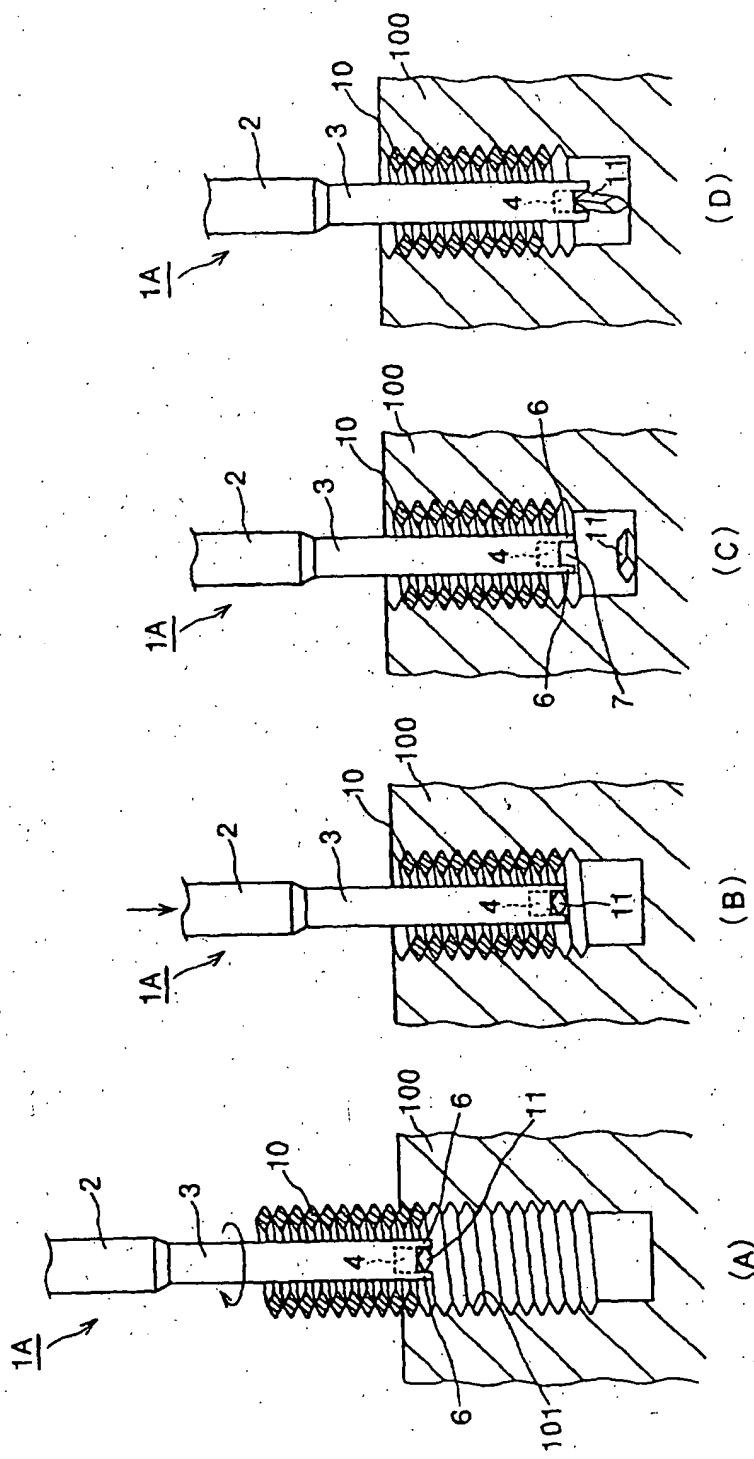


FIG.11

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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP00/05417

A. CLASSIFICATION OF SUBJECT MATTER  
Int.Cl? B25B33/00, 27/14, 27/30

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
Int.Cl? B25B33/00, 27/14, 27/30Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
Jitsuyo Shinan Koho 1926-1996 Kokai Jitsuyo Shinan Koho 1971-2000  
Toroku Jitsuyo Shinan Koho 1994-2000

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	JP, 2000-61860, A (Nippon Denshi Musen Denshi K.K.), 29 February, 2000 (29.02.00), Claims; abstract; Figs. 1 to 6 (Family: none)	1-5
PA	JP, 11-156751, A (NEC Corporation), 15 June, 1999 (15.06.99), Claims; abstract; Figs. 1 to 6 (Family: none)	6
A		1-6

 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search 07 November, 2000 (07.11.00)	Date of mailing of the international search report 14 November, 2000 (14.11.00)
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